

Radiation Shielding Utilizing A High Temperature Superconducting Magnet

Completed Technology Project (2011 - 2012)



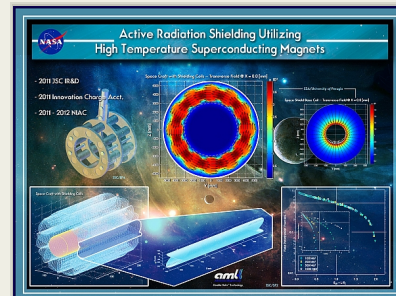
Project Introduction

Project objective is to evaluate human radiation protection and architecture utilizing existing superconducting magnet technology while attempting to significantly reduce shielding mass, manage habitation module sizing, and vehicle cost at the expense of accepting some level of radiation (protecting from SPE and some GCR radiation). Complete radiation protection comes with great cost through huge mass designs. Protection performance will be evaluated using a percent reduction factor and acceptable dose equivalent. This combined with shorter duration exploration missions utilizing high power electric propulsion systems and creative shielding architectures beyond Low Earth Orbit is the approach to managing crew health.

This project aims to leverage near-term high-temperature superconducting technologies to assess applicability of magnetic shielding for protecting against exposure from Solar Proton Events (SPEs) and dose reduction for Galactic Cosmic Radiation (GCR) utilizing HTS magnet technology concepts. Shield design can have substantially lower mass/power requirements than previously thought. Modeling efforts will include: (1) Modeling of realistic magnetic fields (Halbach array) utilizing full-scale finite-element methods that include fringing fields; (2) leveraging of recent plasma trapping results (Rutherford/Appleton Laboratory); (3) and if time permits, a habitat model will be included as parasitic shielding. Testing will be conducted with a magnet array for plasma trapping facilitated at Ad Astra utilizing current Space Act Agreements. The study will evaluate shorter duration missions from a power, mass, flux reduction perspective and provide an active and passive shielding mass comparison.

Anticipated Benefits

Radiation shielding is a technical challenge that needs to be addressed to enable human exploration of space.



Project Image Radiation Shielding Utilizing A High Temperature Superconducting Magnet

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations

Texas

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Innovation Fund: JSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Carlos H Westhelle

Project Manager:

Shayne C Westover

Principal Investigator:

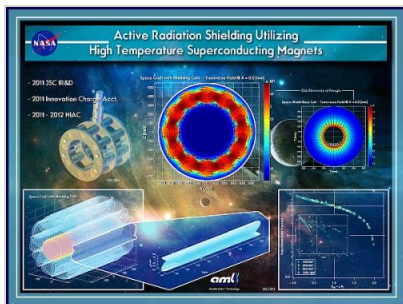
Shayne C Westover

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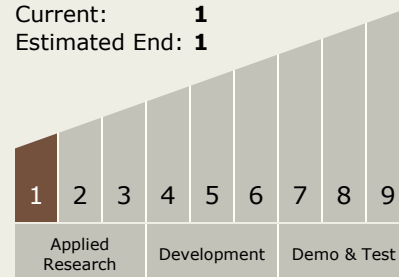
Images


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Project Image Radiation Shielding Utilizing A High Temperature Superconducting Magnet
(<https://techport.nasa.gov/image/2211>)

Technology Maturity (TRL)

Start: **1**
Current: **1**
Estimated End: **1**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.5 Radiation
 - └ TX06.5.3 Protection Systems